OUTBREAK SPOTLIGHT….

"Outbreak Spotlight" is a regularly appearing feature in the *Indiana Epidemiology Newsletter* to illustrate the importance of various aspects of outbreak investigation. The event described below illustrates how a seemingly routine complaint may be an indication of a much larger situation.

The Tip of The Iceberg (Lettuce)

Sandy Gorsuch
Field Epidemiologist
ISDH Epidemiology Resource Center

Background

On February 6, 2004, the Tippecanoe County Health Department (TCHD) notified the Indiana State Department of Health (ISDH) that two separate callers reported possible foodborne illness. On February 3, one caller reported that she and two coworkers ate lunch at Restaurant A on Friday, January 30, and became ill on Sunday, February 1, with vomiting and diarrhea. According to the complainant, all three patrons ate mesquite chicken salad with various dressings. On February 5, the TCHD received a second telephone complaint regarding a patron and eight other people who ate lunch at Restaurant A on Saturday, January 31, 2004. Five people from this party of nine became ill approximately 24 hours later with vomiting and/or diarrhea.

Epidemiologic Investigation

The ISDH and the TCHD initiated a collaborative investigation of this outbreak. A case-control study was conducted in order to describe the outbreak and to determine if the source was food related. A list of menu items was obtained from Restaurant A. The ISDH developed a questionnaire for restaurant patrons and staff to collect demographic information, clinical histories, and exposure histories. A case was defined as any previously healthy patron or staff member who became ill with acute onset of vomiting or diarrhea after consuming food or beverages at Restaurant A on or after January 1, 2004, or any previously healthy person who had direct contact with an ill person, as described above, and subsequently became ill with vomiting or diarrhea. Any Restaurant A patron or staff member who was healthy during the same time frame was eligible to be included as a control. Any Restaurant A patron or staff member who was ill with signs or symptoms that did not include vomiting or diarrhea within the time frame was excluded from the study.

The ISDH and the TCHD conducted telephone interviews with patrons, and the ISDH conducted face-to-face and telephone interviews with restaurant staff. Nineteen people met the case definition, and seven people were identified as controls. To identify additional cases, the ISDH contacted health care providers within Tippecanoe County, and local health departments in Districts 2, 4, and 7 were encouraged to contact health care providers in their Districts. Two cases and two controls were identified as a result of this active surveillance.

The most common signs and symptoms reported by the nineteen cases included vomiting (89.5%), diarrhea (89.5%), and nausea (68%). Other signs and symptoms reported were fatigue, chills, headache, body aches, abdominal cramps, fever (median: 100.6°F), and bloody stool. The median duration of the illness was 24.5 hours (range: 7 hours to 164 hours). The median incubation period of the illness was 33.0 hours (range: 8 hours to 47.5 hours). At least four people consulted a physician, but none was hospitalized overnight. Ten individuals submitted stool specimens for laboratory analysis (see "Laboratory Results").

Statistical analysis of the food indicated lettuce, whether prepared as a lettuce salad or a garnish on a sandwich, was possibly associated with the illness (odds ratio = 7.11, p-value = 0.057221.) Although the p-value is slightly greater than the statistical cutoff of 0.05, the value approaches statistical significance.

Environmental Assessment

Prompted by the initial telephone food complaint regarding chicken salad on February 3, 2004, a TCHD environmental health specialist conducted a routine inspection of Restaurant A on February 4, 2004, and reviewed the preparation of chicken. Critical violations of the Indiana Retail Food Establishment Sanitation Requirements (410 IAC 7-20) included:

- sanitizer in the dish machine measuring (0) ppm;
- an employee using bare hands to touch plate garnishes and to switch bun tops, sliced tomato, and lettuce;
- sour cream measuring between 47^{o} F and 51^{o} F, above the required 41^{o}F limit;
- sliced ham and cheese measuring at 45^{o}F above the required 41^{o}F limit in a refrigerated unit under a microwave oven.

Corrective measures were discussed upon observation of violations. No food specimens were available for laboratory examination.

On February 6, 2004, the TCHD environmental health specialists contacted restaurant management as follow-up to the second complaint and delivered ISDH specimen collection containers to restaurant staff to identify asymptomatic carriers. A follow-up inspection was also conducted. Previous violations identified on February 4 were corrected, but new violations were identified. Critical violations included:

- quaternary sanitizer measured (0) ppm;
- raw beef measured 49^{o}F and marinade measured 51^{o}F, both above the required 41^{o}F limit;
- an employee on front line using the same gloves to handle raw meat and clean dishes;
- the dishwasher person failing to wash hands properly prior to unloading clean dishes.

Corrective measures were discussed upon observation of violations. No food specimens were available for laboratory examination.

On February 11, 2004, the ISDH notified the TCHD that three cases of *Norovirus* had been confirmed from ill restaurant employees (see "Laboratory Results"). TCHD representatives informed restaurant management staff members of the results, faxed information regarding *Norovirus*, stressed the importance of thorough hand washing, recommended disinfecting the entire restaurant using a 50 ppm chlorine bleach-based cleaner, and ordered exclusion of employees exhibiting vomiting or diarrhea from work until symptom free. TCHD representatives also mailed a *Norovirus* fact sheet, which included outbreak control and prevention measures, to over six hundred food establishments in Tippecanoe County.

On February 12, 2004, restaurant management notified the TCHD that the required corrective measures were implemented and requested a new inspection. A TCHD representative requested a written copy of the restaurant's employee illness exclusion and restriction policy. According to management, there was no written policy. However, if employees arrive at work ill, they are sent home. Employees are made aware of this policy during employee orientation.

On February 13, 2004, TCHD and ISDH representatives conducted a third inspection of Restaurant A. A chlorine bleach odor was noted upon entering the restaurant. The restaurant regional manager provided a written employee illness exclusion policy that did not include restriction. Previous violations identified on February 6 were corrected, but two new critical violations were identified, including moldy popguns in the bar, and the bartender using bare hands to dispense fruit garnishes into cups. Corrective measures were discussed upon observation of violations and were corrected that day. Three food samples were collected, including an uncut head of lettuce, a prepared individual lettuce salad, and two cooked rolls. These were submitted to the ISDH Laboratories for analysis (see "Laboratory Results").

On February 26, 2004, in response to a verbal report of laboratory food sample analysis (see Table 1), representatives of the TCHD conducted a review of the restaurant's lettuce preparation procedures. Based on their findings, the TCHD made the following suggestions:

1. Sanitize the sink, lettuce chopper, and slicer before and after each use.
2. Wash hands before putting on gloves each time.
3. Wear gloves when handling lettuce at all stages.
4. Use plastic wrap instead of trash bags containing ice to place on top of washed lettuce.
5. Check plates for cleanliness.

Seven restaurant staff members reported signs and symptoms consistent with *Norovirus* with onset dates between January 22 and February 3. According to reported illness onset dates and the restaurant work schedule for January 30 through February 1, at least two symptomatic employees worked while ill. One employee who was asymptomatic but tested positive for *Norovirus* worked on January 30-31. The employee identified as the index case reported onset on January 22.

Laboratory Results

Five patrons and five restaurant employees submitted stool specimens to the ISDH Laboratories for analysis. All specimens tested negative for *Salmonella, Shigella, Campylobacter*, and *E. coli* 0157:H7 by culture. All patrons and four employees tested positive for *Norovirus* by reverse transcription-polymerase chain reaction (RT-PCR). One employee tested negative for *Norovirus*.

The ISDH Laboratories do not test food samples for virus, but bacteriological analysis of food samples can serve as a proxy indicator for viral agents and identify a possible vehicle of transmission. Three food samples were submitted for laboratory analysis (see Table 1). The lettuce salad aerobic plate count was 28 million cfu/g, (normal limit = less than 100,000 cfu/g), and the total coliform count was greater than 1100 MPN/g (normal limit = 100 MPN/g), unfit for human consumption. The uncut head of lettuce and cooked rolls tested within normal limits.

The ISDH Food Protection Program Report of Food Sample Analysis Results indicated that the high aerobic plate count and coliform count for the sample of the prepared individual lettuce salad suggested possible temperature abuse, mishandling and/or inadequate hand washing, and recommended that the TCHD review lettuce preparation procedures with management. This supported the hypothesis that the ready-to-eat prepared individual lettuce salad was a possible vehicle of transmission of *Norovirus.*

Conclusion

This investigation confirms that an outbreak of gastroenteritis occurred at Restaurant A from at least January 22 through February 3, 2004. Nineteen cases were identified. Since the restaurant is located near Interstate 65, it was possible for patrons from many locations to be exposed and subsequent cases not reported. Some of the 19 cases were reported from neighboring counties.

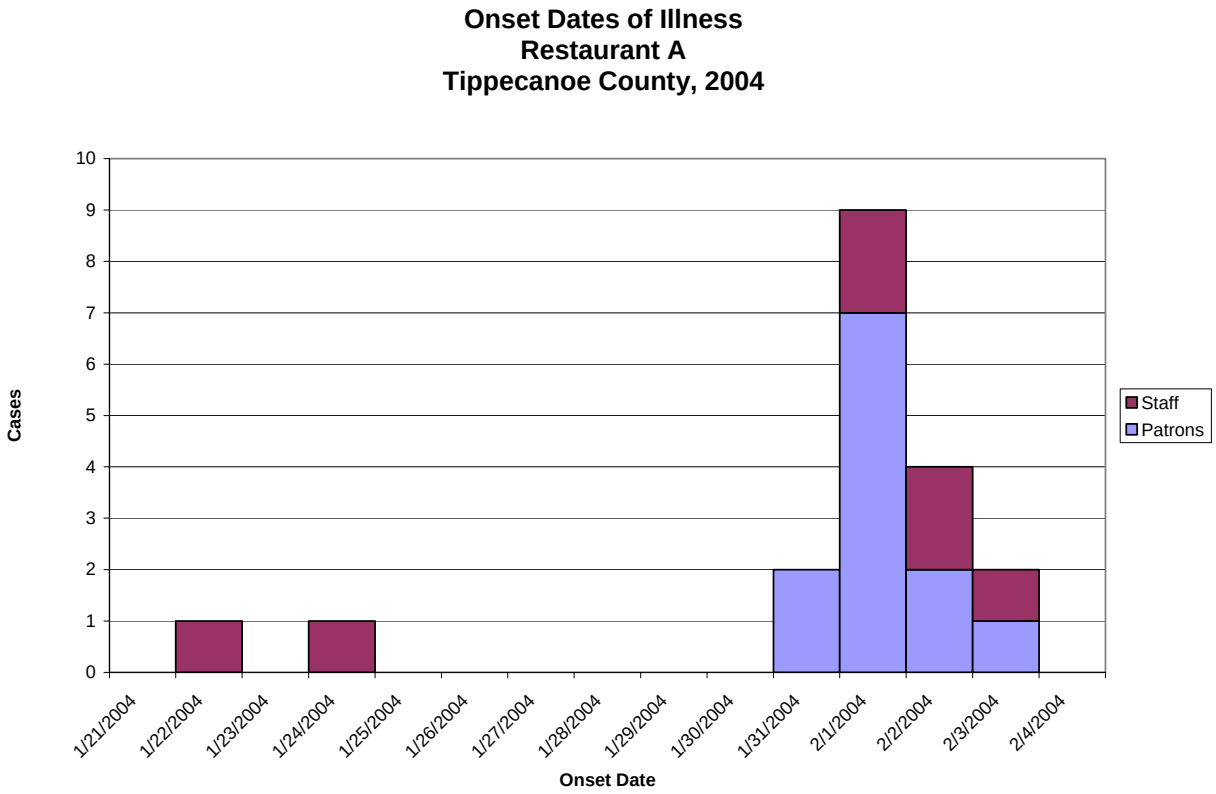
The causative agent of this outbreak was *Norovirus.* The sudden, acute onset of predominant signs and symptoms (vomiting, diarrhea, and nausea), incubation period (median: 33 hours), and duration of symptoms (median: 24.5 hours) reported in this investigation are typical of *Norovirus* outbreaks. Vomiting, watery non-bloody diarrhea, abdominal cramps, nausea, and occasionally a low-grade fever are the most common signs and symptoms of *Norovirus* infection.[1] Nine of the ten stool specimens submitted tested positive for *Norovirus* (see "Laboratory Results"). In addition, stool specimens were negative for common bacterial agents.

Norovirus can be transmitted in three ways: fecal-oral (through eating or drinking fecally contaminated food, liquid or ice), touching a contaminated object or environmental surface and subsequently placing the contaminated hand in one's mouth, or person to person through contact with an infected person.[2] Evidence also suggests transmission may occur from aerosolized infected vomitus droplets that contaminate environmental surfaces and/or fomites, or are swallowed.[2] *Norovirus,* which is shed in stool, is highly contagious and has an infectious dose of less than 100 viral particles.[1] Viral shedding in the stool may occur before symptoms start, but usually begins with onset of symptoms and may continue for at least two weeks after recovery.[2] In this investigation, the known index case tested positive for *Norovirus* 14 days after recovery from the last reported symptom (upset stomach) and 20 days after vomiting and

diarrhea subsided. Studies indicate 30% of *Norovirus* infections are asymptomatic.[2] Although the virus does not multiply outside of the human body, it can survive on environmental surfaces, survive up to 10 ppm of chlorine (above levels recommended for swimming pools and public water systems)[1], survive freezing, and survive temperatures to 140ºF.

Evidence indicated that this outbreak was foodborne. Foodborne transmission occurs when an infected food handler with inadequately washed hands fecally contaminates food, liquid or ice during preparation. The epidemic curve (Figure 1) reflects a common source outbreak with at least one known probable secondary exposure. Four employees, including one who was asymptomatic, tested positive for *Norovirus.* In addition, three other employees met the clinical case criteria. This indicates there was a background of illness at the restaurant. Although some employees may not customarily prepare food, they often shake hands with patrons, handle menus, money, receipts, and touch patrons' plates when food items need to be "re-cooked." The presumed index case with a reported onset on January 22 reported handling patron plates for "re-cooks" the morning of January 22, 2004.

Figure 1.



Food vehicles with greatest risk of *Norovirus* transmission include ready-to-eat or cold foods that require no subsequent cooking or are extensively handled after cooking (e.g., salads, vegetables, bakery items, sandwiches), liquid foods in which virus can uniformly mix (e.g., salad dressing, icing), and shellfish from contaminated waters. The most likely vehicle for infection transmission in this outbreak was lettuce. Lettuce, whether consumed in a prepared individual lettuce salad or on a sandwich, approached statistical significance. No other food vehicle

approached significance. The known index case reportedly ate a prepared individual lettuce salad and exhibited onset of first symptoms 19 hours later.

Laboratory analysis also indicated that the lettuce was the most likely vehicle. The prepared salad exhibited an exceedingly high aerobic plate count and high coliform count. Lettuce, the main ingredient of the salad, may have been a possible vehicle of transmission for those persons who ate lettuce on their sandwiches. One of the two patrons who reported not eating lettuce or salad tested positive for *Norovirus.* Food histories of the seven controls indicated three ate salad on the same dates as identified cases. However, it is not uncommon for contaminating agents to be unevenly distributed in food. The general manager reported lettuce for the salad was prepared twice daily and unused salad was discarded at the end of each day. Therefore, it was possible that only some salads were contaminated if they were prepared by different employees.

Table 1.

ISDH Laboratory Food Sample Bacteriological Analysis Report
Restaurant A, Tippecanoe County
March 1, 2004

Food Item	Petri film APC*	Total Coliforms	*E. coli*
Individual Lettuce Salad	28,000000 cfu/g	>1100 MPN/g	<3.0 MPN/g
Uncut Head of Lettuce	34,000 cfu/g	<3.0 MPN/g	<3.0 MPN/g
Cooked Rolls	140 cfu/g	<3.0 MPN/g	<3.0 MPN/g

coliforms: normal = 100 MPN/g
cfu = colony forming units
MPN = most probable number

Foodborne outbreaks caused by *Norovirus* can be prevented by strictly adhering to the following food safety and prevention measures:

1. Thoroughly wash hands with soap and clean running water for at least 20 seconds before preparing or serving food, between changes in job duties, after using the restroom, before eating, and after cleaning the restroom. Dave Drinan, MS, R.E.H.S, TCHD Chief Food Service Specialist, offered the following hand-washing recommendations:

    a. Above kitchen hand sinks and restroom sinks used by employees, install an automatic timer with a button that can be activated by employees before starting to wash their hands preset to stop after at least 20 seconds.
    b. Access the web site www.handwashingforlife.com to obtain multi-language posters that can be placed above kitchen hand sinks and restroom sinks, and PowerPoint presentations to educate employees.

2. Thoroughly wash all fruits and vegetables before serving, especially if served raw.
3. Maintain a hot holding temperature of 140ºF for potentially hazardous food.
4. Thoroughly clean and disinfect environmental surfaces with a 50 ppm chlorine bleach-based cleaner, particularly surfaces of kitchen equipment, utensils, containers, and sinks used for preparing fruits, vegetables, and potentially high-risk food.
5. Wash restaurant linens in a washing machine at maximum cycle length with hot water and detergent, followed by machine drying.
6. Exclude all food handlers from working while ill with diarrhea and/or vomiting.

References

1. "Norwalk-Like Viruses" Public Health Consequences and Outbreak Management. Centers for Disease Control and Prevention. *MMWR,* June 1, 2001 / 50(9);1-17.

2. Norovirus: Q & A. January 2003. Centers for Disease Control and Prevention web site, http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus-qa.htm